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Jaton

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[54] **METHOD AND APPARATUS FOR APPLYING A REINFORCING LINING BLANK IN A DESIRED POSITION ONTO A SURFACE OF A BOX BLANK**

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[52] **U.S. Cl.** **93/36.6;** 93/36.01; 156/556

[51] **Int. Cl.²** **B31B 1/02**

[58] **Field of Search** ..... 93/36.6, 36.01, 36 R, 93/36 M; 270/58; 156/556, 557

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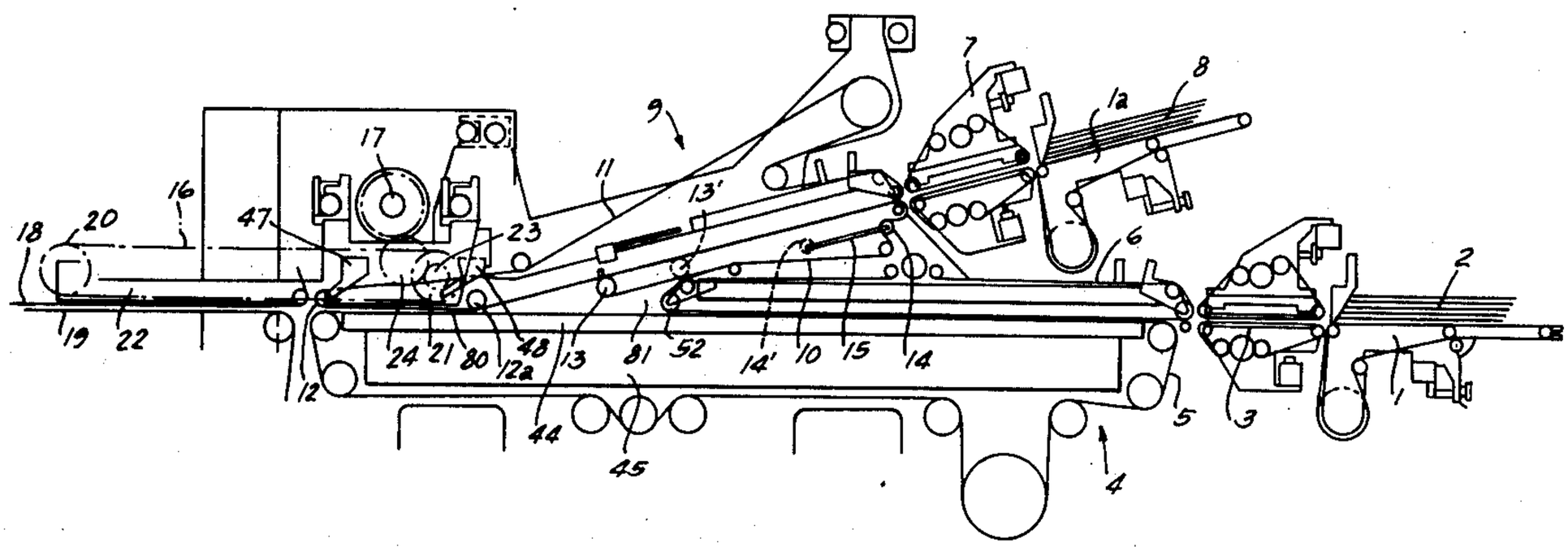
Primary Examiner—James F. Coan
Attorney, Agent, or Firm—Hill, Gross, Simpson, Van Santen, Steadman, Chiara & Simpson

[57] **ABSTRACT**

A method and apparatus for applying a reinforcing liner blank on a moving box blank and shifting the assembled blank into the desired position for a subsequent attachment together characterized by a first belt moving a box blank in one direction, a second belt moving a liner blank and guiding it into surface-to-surface engagement on the moving box blank and the belts coacting to move the box blank and with the liner engaged thereon and cooperating with a shifting device which moves the blanks relative to each other to the desired position prior to joining the blanks together. The shifting device includes at least one endless chain belt having an abutment for engagement by the leading edge of the box blank and a second abutment for engagement by the leading edge of the liner blank which abutments coact with the respective belts to cause slippage of their respective blank on the belt when the leading edge is engaged. Preferably, the apparatus and method include a device for sequentially feeding a box blank into a transporting device which includes the belt engaging the box blank and a similar feeding device for sequentially feeding liner blanks into a transporting device which includes the belt for moving and guiding the liner blanks into the surface engagement with the box blank.

13 Claims, 7 Drawing Figures



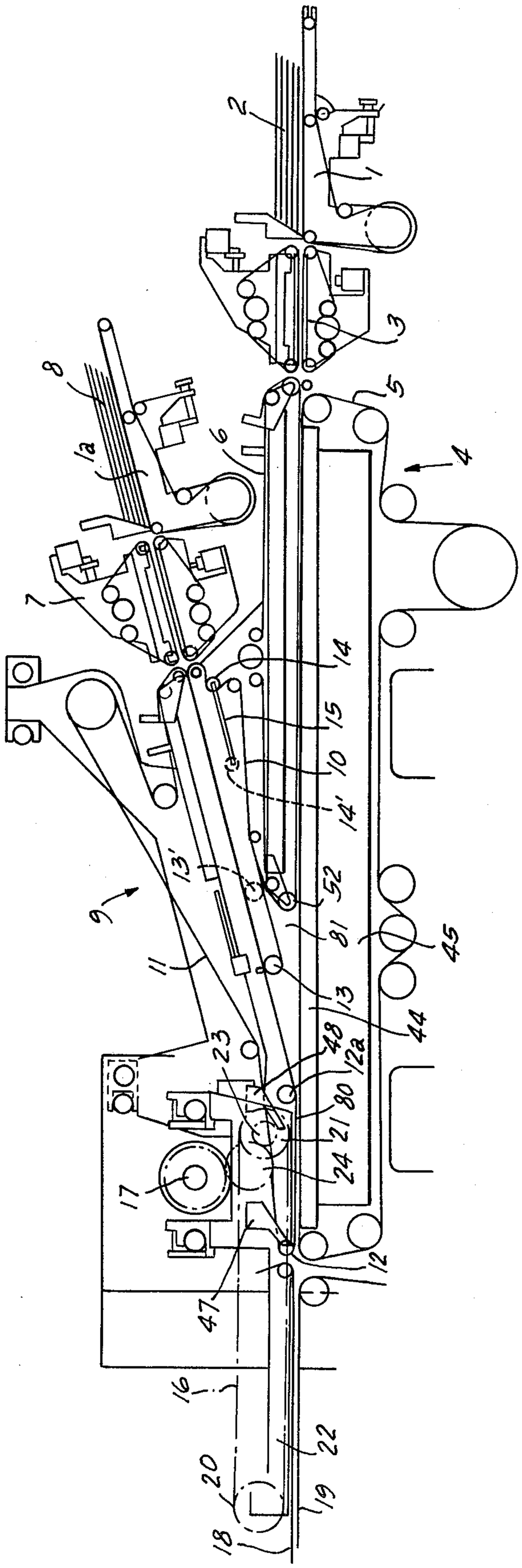

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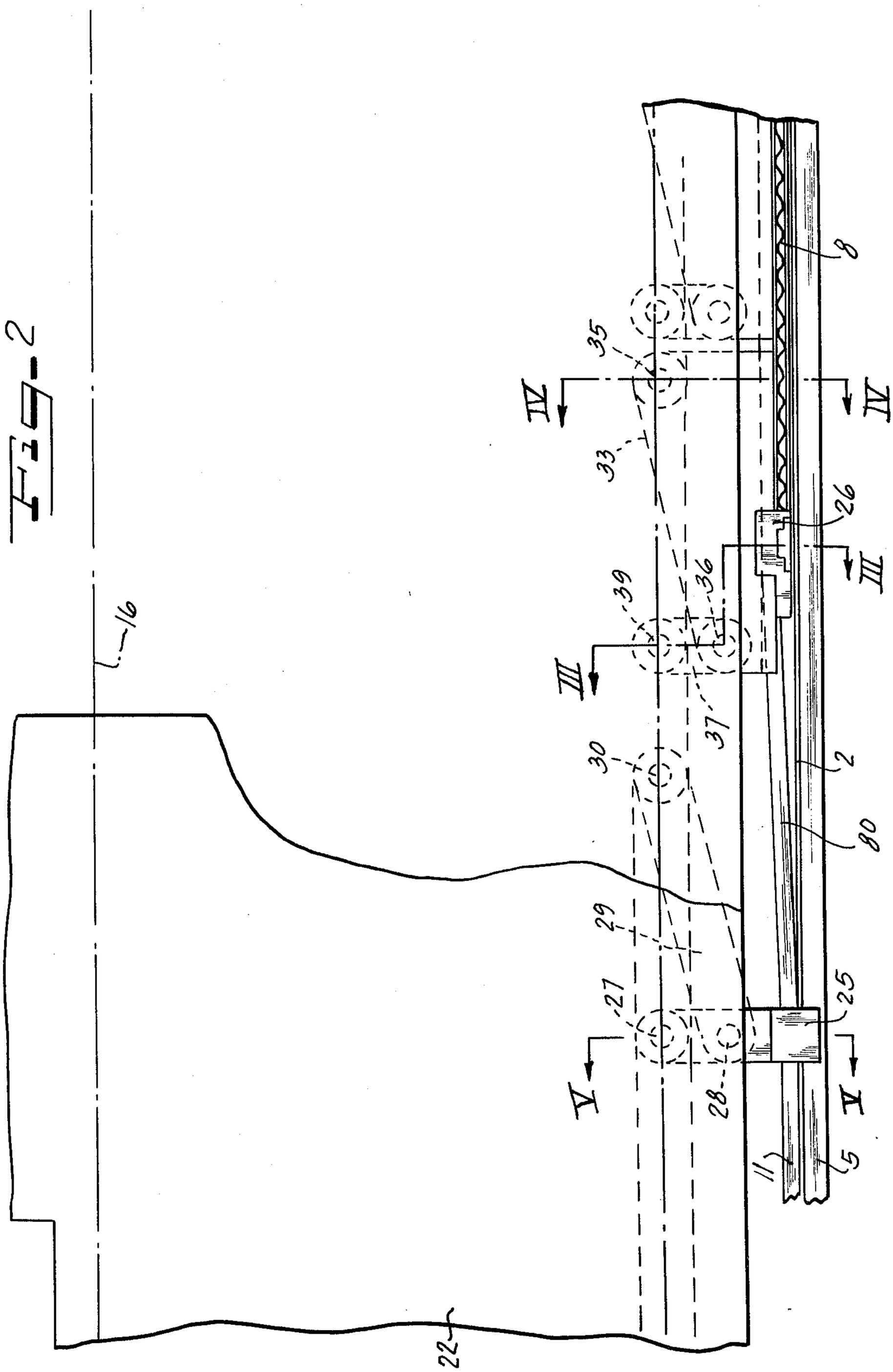
Fig-1

Fig. 2



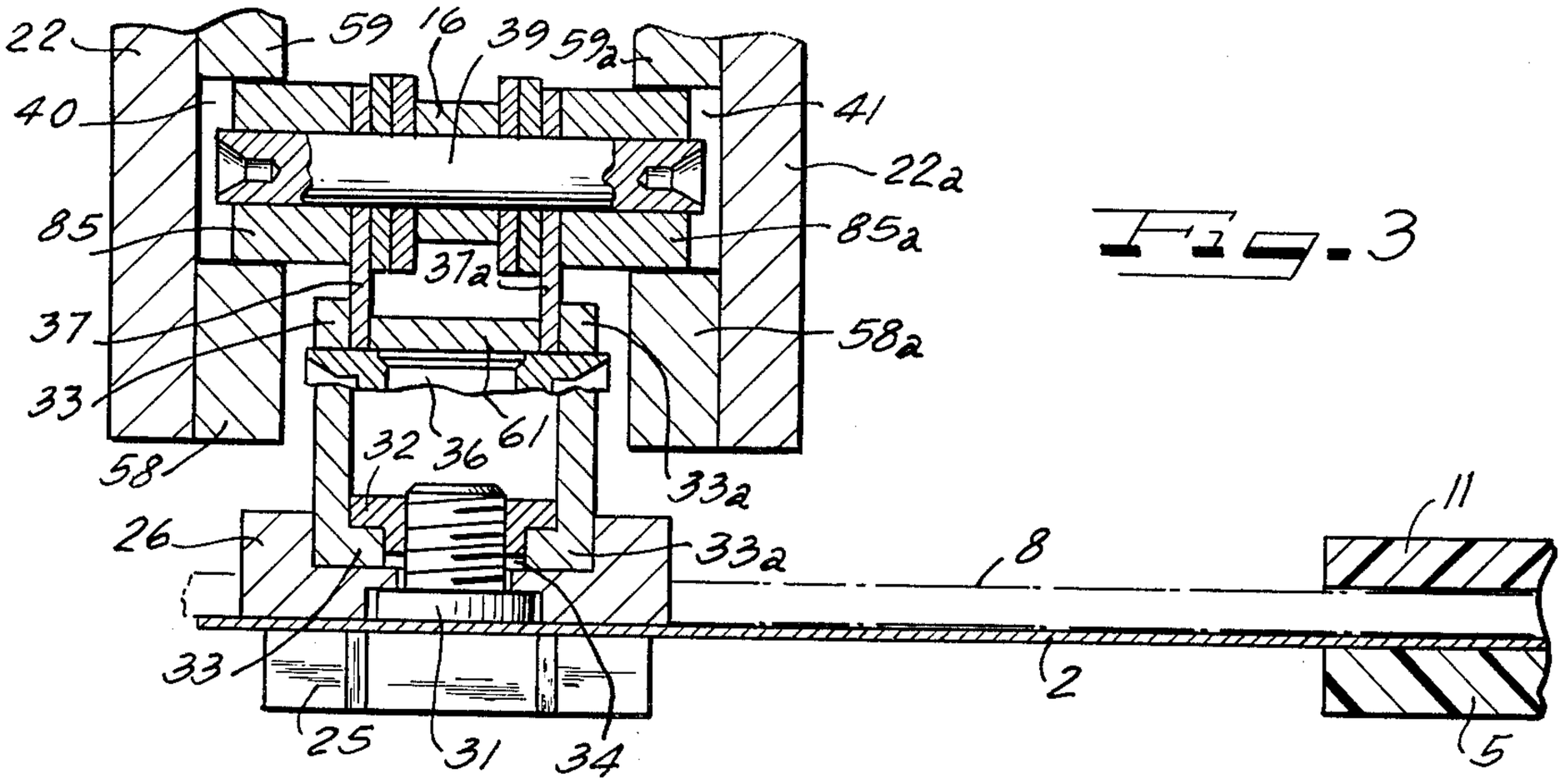


Fig. 3

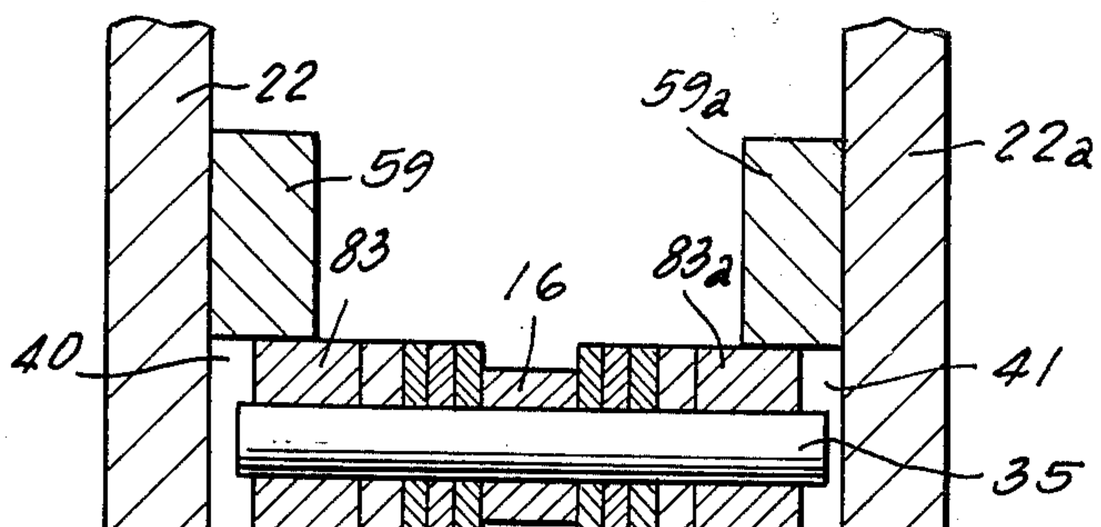
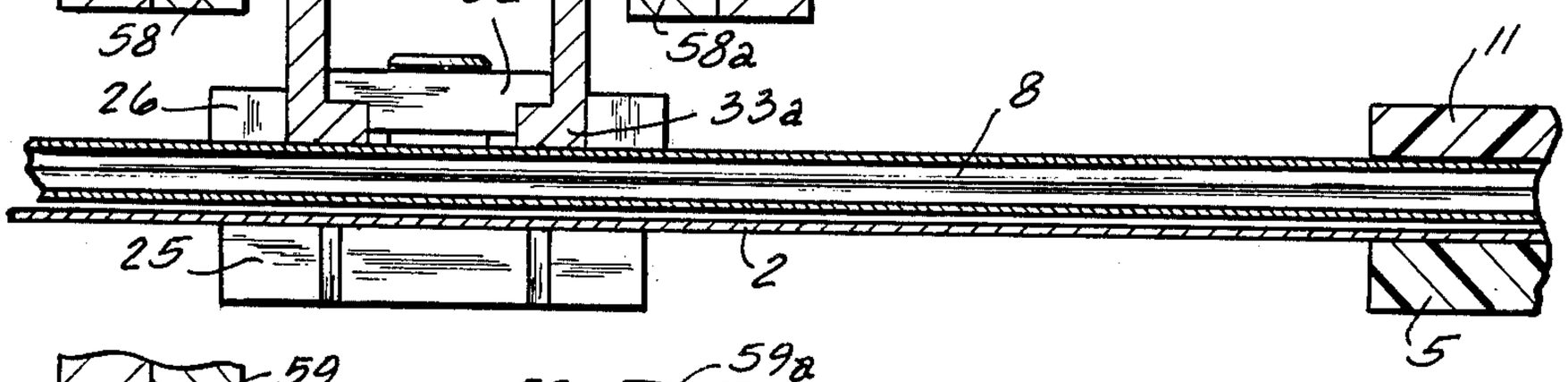


Fig. 4



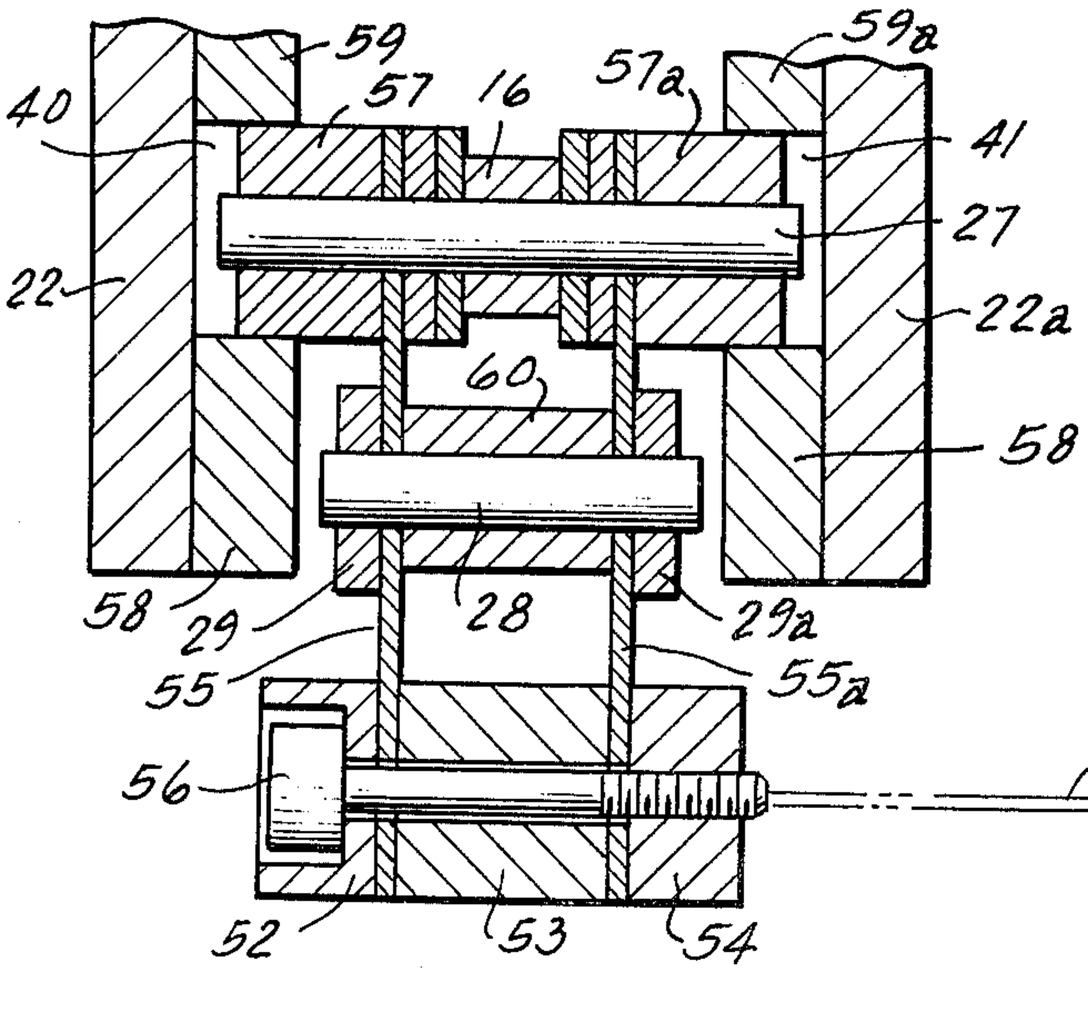


Fig. 5

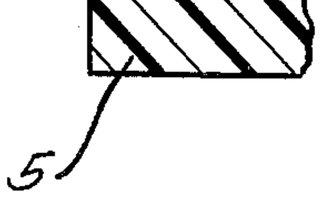


Fig. 6

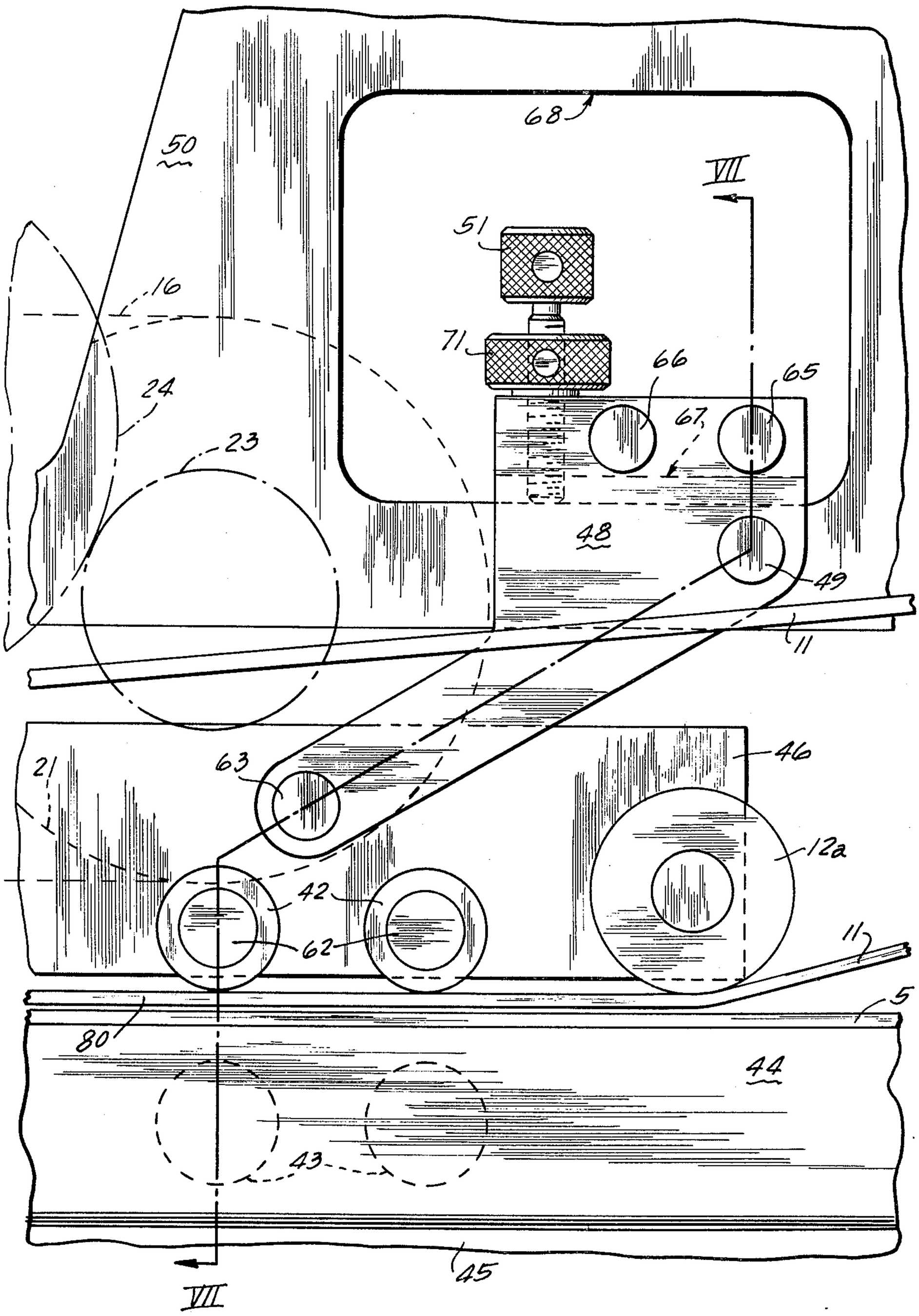

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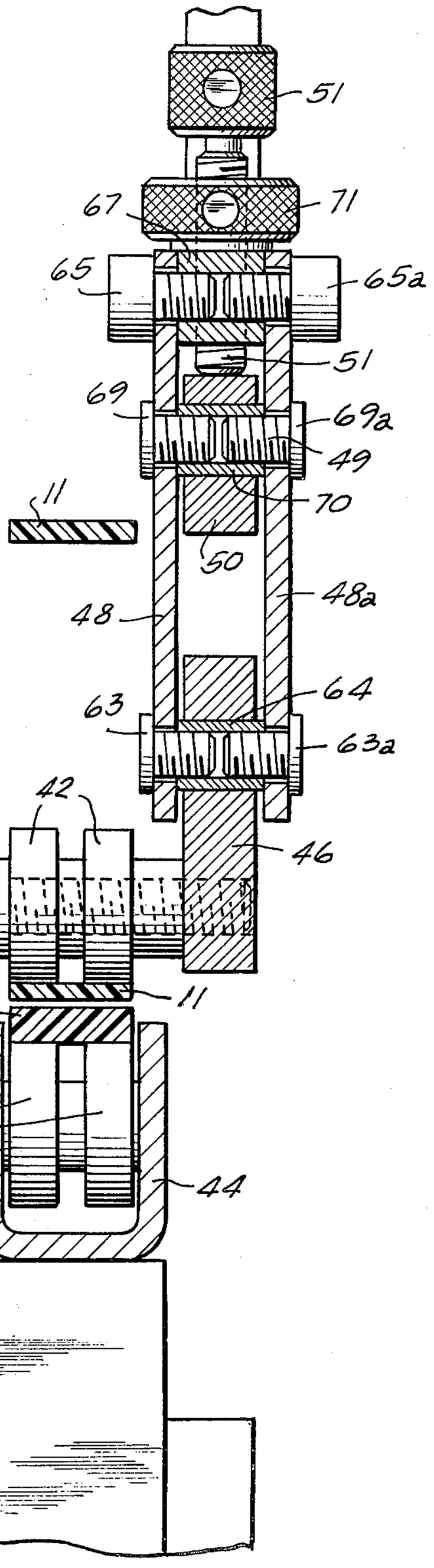
Fig-7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METHOD AND APPARATUS FOR APPLYING A REINFORCING LINING BLANK IN A DESIRED POSITION ONTO A SURFACE OF A BOX BLANK

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is directed to a method and apparatus for applying a reinforcing liner blank in a desired position on a surface of a box blank prior to attachment thereto and particularly prior to performing a folding and gluing operation on the attached or assembled blanks.

2. Prior Art

In prior art methods and apparatuses for positioning a liner blank on a box blank for subsequent attachment, problems exist in transporting the blanks and positioning the blanks in the desired assembled relationship for attachment.

One device which has been proposed for positioning the engaged blanks in the desired relationship includes a lower endless chain with catches or driving dogs which engage contact dogs which engage a rear or trailing edge of the blanks to move the blanks through the device. It has also been proposed to feed the blanks from a stack onto the moving chains by the use of distributing dogs which engage a trailing edge of a lowermost blank in the stack to shift the blank relative to the stack. To position the liner blank on the box blank, the box blank is conveyed by the chains to a given position and held at that position. The liner blank is conveyed by the other chains to a position above the held box blanks and then released and deposited on the stationary box blank. Then the box blank with the liner blank deposited thereon is transported to the next station.

In the proposed design utilizing contact and distributing dogs, the dogs engage the trailing edge of the blank with an impact which is likely to damage an edge of a blank having a certain board quality. This is especially true of corrugated boards which have a corrugated layer having undulation with parallel extending crests and troughs. If the edge of the blank extends parallel and along a crest or trough of an undulation of the corrugated layer, the resistance of the edge is insufficient. If the edge extends transverse or across a plurality of the undulations, the resistance might be sufficient, but the toughness features are generally inadequate to withstand the impacting blows of the dogs without damage to the edge of the blank.

Another difficulty with transporting the blanks by pushing with dogs engaging a rear or trailing edge is the tendency of the blank to bend or curve upward as it is pushed through the device.

In the above-mentioned proposed device utilizing dogs engaging the trailing edges of the blanks, the reinforcing liner blank is moved to a position and then dropped onto the stationary box blank. This requires a discontinuous motion for the blanks in both time and space.

SUMMARY OF THE INVENTION

The present invention is directed to a method and apparatus for applying a reinforcing liner blank in a desired position on the surface of a box blank prior to attachment or joining thereto. The method and apparatus enables the positioning with a smooth movement of the blanks without pushing the rear edges of the blank

and without engaging the edges with an impact force to cause damage thereto.

To accomplish these features, the method and apparatus comprises means for moving a box blank in one direction, means for moving a reinforcing liner blank and guiding the moving liner blank into surface-to-surface engagement with the moving box blank, and while moving the box blank with the liner blank engaged thereon shifting the box blank and liner blank relative to each other and into the desired assembled relationship so that the liner blank is in the desired position on the box blank when attached thereto. Preferably, the means for moving the box blank is a first endless belt, means for supporting the first endless belt for movement in a first endless path and means for moving the belt in one direction along the first path. The means for moving and guiding the liner blank preferably includes a second endless belt, means for supporting the second endless belt for moving along an endless path having a portion inclined to the first endless path and a second portion extending parallel to the first endless path and means for moving the second belt along the second path. The means for shifting preferably includes at least one endless chain belt having a first abutment means supported thereon for engaging the leading edge of a box blank and a second abutment means for engaging a leading edge of a liner blank which abutments coact with the moving belt to cause slippage between the engaged surfaces of the blanks and each blank and its respective belt to move the blanks relative to each other and to the desired position. The apparatus preferably includes feeding means for feeding blanks sequentially onto the first belt and a second feeding means for sequentially feeding the liner blanks into engagement with the second belt.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagrammatic side view of an apparatus according to the present invention for performing the method of the present invention;

FIG. **2** is an enlarged side view with portions broken away of the apparatus of FIG. **1** illustrating the shifting means of the present invention;

FIG. **3** is a partial cross-sectional view with portions in elevation for purposes of illustration taken along lines III—III of FIG. **2**;

FIG. **4** is a partial cross-sectional view with portions in elevation for purposes of illustration taken along lines IV—IV of FIG. **2**;

FIG. **5** is a partial cross-sectional view with portions in elevation for purposes of illustration taken along lines V—V of FIG. **2**;

FIG. **6** is a partial side view with portions broken away and removed for purposes of illustration of the device for supporting the belts; and

FIG. **7** is a partial cross-sectional view with portions in elevation for purposes of illustration taken along lines VII—VII of FIG. **6**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The principles of the present invention are particularly useful in an apparatus diagrammatically illustrated in FIG. **1**. The apparatus of FIG. **1** has a frame for supporting various devices including feeding means illustrated as a first feeding device **1** for sequentially feeding a blank **2** from a pile of blanks into a conveying device illustrated as a belt conveyor **3**. The feeding

device **1** utilizes an endless belt which is intermittently advanced to transport the bottommost blank **2** from the pile and a more detailed description of this device is contained in my copending U.S. patent application, Ser. No. 441,438 filed Feb. 11, 1974 which issued on Sept. 23, 1975, as U.S. Pat. No. 3,907,278. Coaction of the devices **1** and **3** provide a timed feed of a box blank **2** into a blank moving means, generally indicated as a belt conveyor means **4** which has at least one lower endless belt **5** and at least one upper endless belt **6.** The conveyor means **4** includes separate means for supporting each of the belts **5** and **6** for movement in an endless path and means for driving each of the endless belts **5** and **6.**

The apparatus also includes means for sequentially feeding reinforcing liner blanks **8** from a pile which means, as illustrated, is a feeding device **1***a* which is identical to the device **1.** The device **1***a* feeds the lowermost liner blank **8** from the pile into a conveying device **7** and coacts therewith to feed the blank **8** at the desired time interval into a linear blank moving and guiding means illustrated as a belt conveyor **9** which includes at least one lower endless belt **10** and at least one upper endless belt **11.** The conveying device **9** includes means for supporting each of the endless belts **10** and **11** in an endless path and means for moving each of the belts along their respective paths. As illustrated, the plane of travel of the liner blank **8** from the feeding device **1***a* through the conveyor **7** and into the conveyor device **9** is in a plane which is inclined to the plane of travel of the box blanks **2** transported by the conveying device **4.** As mentioned, the driving means and supporting means for each of the belts of the conveyors **4** and **9** which supporting means includes tensioning devices are conventional elements for belt conveyors and not illustrated in detail.

A special feature of the conveyor **4** is that the upper belt or belts **6** extend only over a part of the length of travel of the lower belts **5.** In the belt conveyor **9,** the path of the upper belt or belts **11** has an incline portion and has a horizontal portion **80** which is defined by the rollers **12** and **12***a* which horizontal portion extends parallel to a path of the lower belt **5** of the conveyor **4** and coacts therewith to move a pair of superimposed blanks. The lower belts **10** of the conveyor **9** only extend along a portion of the inclined portion of the path of the belts **11.** The length of this portion is controlled by the position of the roller **13** which may be adjusted between the position illustrated in bold lines to a position indicated at **13'** and the support means for the belt or belts **10** includes a take-up roller **14** which is movable in a slot **15** to an inward position indicated at **14'.** The adjustable position of the roller **13** enables the machine to be adjusted for various lengths of the blanks being processed.

Along the track defined by the upper belt or belts **6** of the conveyor **4** the device can be provided with folding and prebreaking devices which are known in the art to act on the box blank as it is being conveyed between the belts **5** and **6.** Also, the device may include an adhesive applicating means for applying an adhesive such as glue onto the upper surface of the box blank **2** as it is disengaged by the upper belt or belts **6.** The applicating means is a conventional adhesive applying device which may either apply the adhesive at predetermined points or as a continuous layer and the device which is not illustrated is located generally in the area indicated by the element **81.**

On the left-hand end of the machine frame as illustrated in FIG. **1,** a pair of endless chains **16** are provided. The chains **16,** which are sprocket type chains, move on an endless path which is defined by gears or sprocket wheels **20,21** with a portion of the path extending parallel to the common track of the belt **5** and the portion **80** of the belts **11.** The endless chains **16** ensure the position of the reinforcing liner blank **8** on the box blank **2** whether or not an adhesive has been applied thereto as the superimposed blanks are moved by the coaction of the belts **5** and **11.** The endless chains **16** move at a slightly lesser speed than the belt **5** and are driven by means of toothed wheel or gear **17** which meshes with a counter gear **24** which in turn meshes with a pinion **23** which is keyed on the shaft of the gear **21.**

As illustrated, the chains **16** whose gear wheels **20** and **21** are supported in frame members **22** extend passed the termination of the belts **5** and **11** and remain in contact with the superimposed aligned blanks as they are discharged into a prebreaker whose inlet is schematically presented by the belts **18** and **19.**

Referring to FIGS. **2–5,** each endless chain **16** includes a certain number of first abutment means **25** for engaging a leading edge of the blank **2** and a certain number of second abutment means **26** for engaging the leading edge of the liner blanks **8.** The spacing between the first abutment means on the chain **16** is dependent on the length of the box blank **2** and the desired spacing between successive moving blanks **2.** Each first abutment means **25** (FIG. **5**) includes three rectangular blocks **52, 53, 54** which are assembled in a sandwichwise relation on two parallel-vertical plates **55, 55***a* by means of a threaded fastener such as a screw **56.** The block **53** acts as an intermediate or spacing piece between the plates **55** and **55***a*, which are joined to the chain **16** by means of a pin or axle **27** which extends past the sides of the chain and receives cylindrical rollers or blocks **57** and **57***a*. The rollers **57** and **57***a* are held on the shaft or pin **27** which may have its ends deformed or expanded in a manner similar to a hollow rivet. The roller **57** is received between a pair of guide members **58** and **59** mounted on a frame member **22** which members define a groove **40.** In a similar manner, the roller or block **57***a* is received between guide members **58***a* and **59***a* which are carried on a frame member **22***a* and define a groove **41.** Between the pin **27** and the abutment means **25,** the plates **55** and **55***a* are connected to parallel connecting rods or links **29** and **29***a* by means of a shaft or pin which also supports an intermediate piece **60** which acts as a spacing between the plates **55** and **55***a*. As best illustrated in FIG. **2,** the other end of the connecting rods **29** and **29***a* are connected to the endless chain **16** by means of a shaft or pin **30.** The connecting rods **29** and **29***a* ensure the position of the first abutment means **25** and enable rotation of the endless chain **16** on its gears or sprocket wheels **20** and **21.**

The second abutment means **26** are connected in a similar fashion to the endless chains **16.** However, their position on the chains **16** relative to the first abutment means **25** can be modified. The second abutment means is adjustably connected on a pair of parallel plates **33** and **33***a* by means of a screw **31** threaded into a T-nut **32.** The plates **33** and **33***a* as illustrated in FIG. **3** have an L-shaped profile formed by an inturned flange on the lower edge of the plate which flanges coact to form a sliding track along which the abutment

means **26** can be adjusted by means of the fastening means formed by the screws **31** and the nut **32.** The plates **33** and **33***a* have trapezoidal shape (FIG. **2**) and are connected to the endless chains **16** by means of a pin or shaft **35** which has rollers or cylindrical blocks **83** and **83***a* disposed on the extending ends and received in the grooves **40** and **41.** The forward end of each of the sides **33, 33***a* are connected by a pin **36** to connecting links **37, 37***a* which connecting links are spaced by a spacing member **61** received on the pin **36.** The other end of the connecting links **37** and **37***a* are connected by a pin **39** to a link of the chain **16** and the pin **39** supports rollers or cylindrical blocks **85** and **85***a* which are also received in the grooves **40** and **41.**

As best illustrated in FIGS. **6** and **7,** the support means for the lower belt **5** includes a plurality of fixed rollers **43** which are mounted for rotation in a U-shaped or channel member **44** which is supported on a frame member **45.** However, the means for supporting the belt **11** includes the roller **12***a* and a plurality of pressure rollers **42.** The pressue rollers **42** are mounted for rotation on a movable beam **46** by thread fasteners such as a threaded axle **62.** In a similar manner, the roller **12***a* is also mounted.

The movable beam **46** is suspended at two points on two pairs of oscillating braces **47** and **48** with each brace being composed of two members such as members **48** and **48***a* (FIG. **7**). The beam is suspended on the pair of members **48** and **48***a* by means of two screws **63, 63***a* which are received in a threaded bearing bushing or intermediate piece **64** disposed is an aperture in member **46** and which member **64** acts as a rigid connection for the two members **48** and **48***a*. The upper ends of these members are connected to one another at two points in a similar manner by screws **65** and **66** which engage a common intermediate piece **67.** The upper end is received in an aperture **68** of a frame member **50** with the member **48** and **48***a* extended on opposite sides thereof and is pivotably connected to the frame **50** by a pivot connection **49.** The connection **49** is formed by a pair of screws **69, 69***a* threaded into a bearing bushing **70** received in an aperture in the member **50.** The member **67** receives an adjustment or stop screw **51** which has a stop nut **71.** The adjustment screw **51** extends through the member **67** and engages a periphery of the opening **68** to limit movement of the oscillating brace **48** in a counterclockwise direction and thus limit the amount of movement of the rollers **12***a* and **42** toward the fixed rollers **43** supporting the lower belt **5.** The brace **47** is mounted in a similar fashion so that the beam **46** may oscillate vertically relative to the fixed channel **44.**

The rollers **42** due to this mounting arrangement will apply preloading pressure on the blanks passing between portion **80** of the belt **11** and the belt **5.** This pressure is determined by the weight of the beam **46** along with the weight of the oscillating braces **47** and **48.** When blanks of a different size are used, adjustment of the adjustment screws **51** enables adjusting the amount of pressure and changing the clearance between the two belts **11** and **5** and therefore allows the controlling of the amount of pressure applied on the superimposed blanks being moved by the portion **80** of the belt **11** and the belt **5.**

In operation, a box blank **2** and a reinforcing liner blank **8** are introduced into the respective conveying devices **4** and **9** with the device **1***a* introducing the blank **8** after the device **1** has introduced blank **2.** Preferably, the lag between the introduction is so the leading edge of blank **8** is placed in a following relation to the leading edge of blank **2.** It is also preferred that the belt **11** of the conveyor **9** moves at a slightly faster rate than the belt **5.** The purpose of the lag between the introduction of the box blank **2** and the liner blank **8** is to ensure the guiding of the blank **8** onto a surface of the blank **2.** As mentioned above, as the blank **2** leaves the engagement with the belt **6,** adhesive is applied to the upper surface.

With the blank **8** guided onto the exposed surface of the blank **2** and into the surface-to-surface engagement, the two superimposed blanks **2** and **8** are engaged between the belt **5** and the portion **80** of the belt **11.** The coefficient of friction between the engaged surfaces of the blanks **2** and **8** even with the presence of the adhesive is less than the coefficient of friction of each blank with its respective belts **5** and **11** so that different rate of movement of the belts **5** and **11** is compensated by relative movement between the two blanks.

In the preferred operation of the method and the apparatus, the belt **11** is moving faster than the belt **5** so that the leading edge of the liner **8** will contact the second abutment means **26** prior to the box blank **2** engaging the first abutment means **25.** As the leading edge of the liner blank **8** engages the second abutment **26** which is being carried on the endless chain **16** at a speed less than the speed of both belts, the abutment will restrain movement of the blank and cause sliding of the liner blank on the belt **11** and on the surface of the box blank **2.** This sliding continues until the leading edge of the box blank engages the first abutment means **25** which causes sliding of the box blank **2** on the belt **5.** When both the box blank and the liner blank have engaged their respective abutment means, they are in the desired position for being interconnected either by the previously applied adhesive or by other mechanical joining means such as a stitching device which may be located at the discharge end of the belts adjacent to the roller **12.**

As described above, the speed of the second belt **11** was faster than the speed of movement of the first belt **5** so that the liner blank was the first blank to engage its abutment. Such a selection of speeds is desirable so it could minimize sliding of the box blank **2** on the belt **5.** By limiting the amount of sliding of the box blank **2,** which usually has printing on the surface engaged by belt **5,** damage such as mackling or soiling, which is due to the sliding of the printed box blank on the belt **5,** is minimized.

The speeds of the belts **11, 5** and the chains **16** are adjusted so that the relative motion of the liner blanks compared to the box blanks will ensure engagement with the respective abutment means with the minimum amount of impact on the leading edge of each blank and so that the movement of the blanks is as smooth and continuous as possible.

Although minor modifications may be suggested by those versed in the art, it should be understood that I wish to employ within the scope of the patent granted hereon, all such modifications as reasonably and properly come within the scope of my contribution to the art.

I claim:

1. A method of applying a reinforcing liner blank in a desired position on a surface of a box blank prior to attachment thereto and particularly prior to perform-

ing a folding and gluing operation on the attached blanks comprising the steps of moving a box blank in one direction, moving a reinforcing liner blank and guiding the moving liner blank into surface-to-surface engagement with the moving box blank, moving the box blank with the liner blank engaged thereon, and subsequently shifting the box blank and liner blank relative to each other and into the desired assembled relationship so that the liner blank is in the desired position on that box blank when attached thereto.

2. A method according to claim **1,** wherein said step of moving the box blank includes engaging the surface of the box blank with a first endless belt and moving the first endless belt along a first endless path, wherein the step of moving and guiding includes engaging a surface of the liner blank with a second endless belt, moving the second endless belt along a second endless path having a first portion inclined to the first endless path and a second portion extending substantially parallel to a portion of the first endless path and coacting therewith to move the box blank with the liner blank engaged thereon, and wherein the step of shifting includes providing a first abutment means for engaging a leading edge of the box blank and a second abutment means for engaging a leading edge of the liner blank, and simultaneously moving the first and second abutment means at the same speed so that as one of the blanks engages its abutment means it slips on its respective belt and the other blank moves relative thereto into engagement with its abutment means.

3. A method according to claim **2,** which includes moving the second belt at a greater speed than the first belt so that the liner blank is engaged on the second abutment means prior to the engagement of the box blank on the first abutment means to minimize slippage of the box blank on the first belt.

4. A method according to claim **2,** which further includes sequentially feeding box blanks onto the first belt and sequentially feeding liner blanks into engagement with the second belt.

5. A method according to claim **4,** which includes applying an adhesive on a surface of the box blank after it is fed onto the first belt and prior to the step of guiding of the liner blank onto the box blank so that the blanks will be attached together after shifting to the desired position.

6. An apparatus for applying a reinforcing liner blank in the desired position on a surface of a box blank prior to attachment thereto comprising a frame, means disposed on said frame for moving a box blank in one direction, means disposed on the frame for moving a reinforcing liner blank and guiding the moving liner blank into surface-to-surface engagement with the moving box blank, means disposed on the frame for moving the box blank with the liner blank engaged thereon including means for shifting the moving box blank and liner blank relative to each other and into the desired assembled relationship so that the liner blank is in the desired position on the box blank when attached thereto.

7. An apparatus according to claim **6,** wherein said means for moving the box blank includes a first endless belt engaging a surface of the box blank, means for supporting the belt for movement along a first endless path, and means for moving the belt in one direction along the path, wherein the means for moving and guiding includes a second endless belt engaging a surface of the liner blank, means for supporting the second belt for movement along a second endless path and means for moving the second belt in one direction along said second path, said means for supporting the second belt providing a portion of the second path extending parallel to a portion of the first path, said second belt in said portion of the second path coacting with the first belt in said portion of the first path to form said means for moving the box blank with the liner blank engaged thereon, and wherein said means for shifting includes at least one endless chain having a first abutment means for engaging a leading edge of a box blank and a second abutment means for engaging a leading edge of the liner blank, said chain being positioned adjacent to said parallel portions of the first and second paths to coact with the first and second endless belts to shift the moving engaged blanks relatively to each other to the desired position.

8. An apparatus according to claim **7,** wherein the means for moving the second belt moves the second belt at a speed different than the means for moving the first belt.

9. An apparatus according to claim **7,** wherein the means for supporting the second belt along the second path maintains spacing of said portion from the portion of the first path.

10. An apparatus according to claim **9,** wherein the means for supporting includes a plurality of pressure rollers adjacent said portion of the second path for maintaining pressure on the engaged blanks passing between said portions.

11. An apparatus according to claim **10,** wherein the means for supporting includes oscillating braces and said pressure rollers being mounted for rotation on said braces.

12. An apparatus according to claim **7,** which further includes means disposed on the frame adjacent the shifting means for fastening the liner blank to the box blank subsequent to the blanks being shifted to the desired position.

13. An apparatus according to claim **6,** which further includes means for feeding box blanks sequentially onto the means for moving the box blanks in one direction, and means for sequentially feeding liner blanks into the means for moving and guiding the liner blanks.

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